

AMENDED CLAIMS

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claims 1-46 replaced by amended claims 1-53 (13 pages)].

1. An automated planter comprising:
- 5 a) means adapted to extract a plant out of a propagation tray;
- b) a delivery assembly arranged to receive extracted plants and to deliver the plants to the ground;
- c) plant transport means arranged to receive extracted plants from the extraction means to present said
- 10 plants to the delivery assembly;
- characterised in that
- the plant transport means comprises a first and a second plant conveyor, each conveyor being adapted to receive extracted plants, and control means operable to
- 15 hold one conveyor in a static state to receive the plants from said plant extraction means whilst the second conveyor is driven to present previously deposited plants to the delivery assembly.
- 20 2. A planter in accordance with claim 1, characterised in that the planter comprises n plant extraction means where n is an integer, the conveyor being adapted to receive n extracted plants substantially simultaneously.
- 25 3. A planter according to claim 1 or claim 2, characterised in that the delivery assembly comprises two endless belts arranged adjacent one another so as to be able to grip the extracted plants between opposing surfaces
- 30 of the belts; and
- drive means arranged to drive the belts at the same speed and such that their opposing surfaces move in the same direction.
- 35 4. A planter according to any of the preceding

claims, characterised in that the transport means are adapted to receive an extracted row of plants from the plant extraction means and to present the extracted plants sequentially to the delivery assembly.

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5. An automated planter comprising;

a) a delivery assembly for receiving extracted plants and to deliver said plants to the ground;

b) a plant transport means to present plants to the delivery assembly, the plant transport means comprising a plurality of holding ports;

c) a controller for controlling the position of the holding ports relative to the delivery assembly;

d) a sensor,

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characterised in that the controller advances the plant transport means in response to the sensor such that the delivery assembly receives plants at a uniform rate.

6. A planter according to any of claims 1 to 4, characterised in that the plant transport means comprises a plurality of holding ports, the planter comprising a controller for controlling the position of the holding ports relative to the delivery assembly and a sensor, the controller advancing the plant transport means in response to the sensor, such that the delivery assembly receives extracted plants at a uniform rate.

7. A planter according to claim 5 or 6, characterised in that the sensor is adapted to sense plant foliage and the controller is adapted to index the plant transport means so that the delivery assembly receives properly developed plants at a uniform rate.

8. A planter according to any of claims 5 to 7, characterised in that the sensor is arranged to detect

foliage of the plant being conveyed by the plant transport means; the sensor being arranged to provide a signal to the controller; the controller being further arranged to control drive means of the plant transport means, whereby,
5 if no foliage or inadequately developed foliage is detected, the plant transport means is controlled accordingly to ensure that plants are presented to the delivery assembly at substantially regular intervals.

10 9. An automated planter comprising:

a) means adapted to extract a plant out of a propagation tray; and

b) a delivery means arranged to receive extracted plants and deliver the plants to the ground;

15 c) the extraction means comprising means for inserting at least one insertion member into the root portion of a plant to grip the root portion;

characterised in that the extraction means are adapted to approach a row of plants from a direction transverse to
20 the row;

the extraction means are adapted to push the foliage of the plants to one side before inserting the inserting member; and

the extraction means are adapted to pull the plant out
25 of the propagation tray.

10. A planter according to any of claims 1 to 8, characterised in that the extraction means comprises means for inserting at least one insertion member into the root
30 portion of a plant to grip the root portion, the extraction means are adapted to approach the row of plants from a direction transverse to the row; the extraction means are adapted to push the foliage of the plant to one side before inserting the insertion member and the extraction means are
35 adapted to pull the plant out of the propagation tray.

11: A planter according to claim 9 or 10, characterised in that the extraction means are adapted to separate the base of the root portion from the top of the propagation tray by a distance of no more than the height of the root portion, the extraction means moving the extracted plant transversely to the upper surface of the propagation tray.

10 12. A planter according to any of claims 9 to 11, characterised in that the extraction means are adapted to pull a row of plants simultaneously from the propagation tray.

15 13. A planter according to any of the preceding claims, characterised in that the extraction means extract a row of plants in alignment and translates the plants in a direction perpendicular to that line, the extraction means depositing the line of plants in relation to the plant transport means.

14. An automated planter comprising:

a) means adapted to extract the plants from a propagation tray;

25 b) holding ports to locate and hold the plants;

characterised in that the planter comprises extraction members adapted for insertion into the root portion of the plants, the extraction members being driven generally transversely into the root portion of the plants to hold the plants in said holding ports whilst said extraction means are withdrawn.

15. A planter according to any of claims 1 to 13, characterised in that the planter comprises holding ports to locate and hold the extracted plants; the planter

comprising extraction members adapted for insertion into the root portion of the plants, the extraction members being driven generally transversely into the root portion of the plants to hold the plants in said holding ports
5 whilst the extraction means are withdrawn.

16. A plant extraction means comprising :

- a) fingers, the fingers being sprung such that ends of the fingers are biased towards each other,
- 10 b) a spacer member located between the fingers, characterised in that
- c) the extraction means comprises means for positioning the spacer member and fingers adjacent to an upper surface of a root portion of a plant and means for
15 holding the position of the spacer member constant whilst driving the fingers down past the sides of the spacer member.

17. A planter according to any of claims 1 to 15,
20 characterised in that the plant extraction means comprises:

- a) fingers, the fingers being sprung such that ends of the fingers are biased towards each other,
- b) a spacer member located between the fingers,
25 characterised in that
- c) the extraction means comprises means for positioning the spacer member and fingers adjacent to an upper surface of a root portion of a plant and means for holding the position of the spacer member constant whilst
30 driving the fingers down past the sides of the spacer member.

18. A plant extraction means comprising:

- a) fingers, the fingers being sprung such that ends
35 of the fingers are biased towards each other,

b) a spacer member located between the fingers, characterised in that the spacer member is adapted to engage with an upper surface of a root portion of a plant to allow the fingers to be driven down past the sides of the spacer member, whereby the fingers are inserted into the root portion and the fingers converge to grip the root portion.

19. A planter according to any of claims 1 to 15, characterised in that the plant extraction means comprises:

a) fingers, the fingers being sprung such that ends of the fingers are biased towards each other, and

b) a spacer member located between the fingers, the spacer member being adapted to engage with an upper surface of a root portion of a plant to allow the fingers to be driven down past the sides of the spacer member whereby the fingers are inserted into the root portion and converge to grip the root portion.

20. A planter according to claim 17 or 19, characterised in that the planter comprises stop means for limiting movement of the spacer member so as to prevent or limit compression of the root portion surface by the spacer member.

21. A planter according to claim 17, 19, or 20, characterised in that the spacer member comprises a cut out to accommodate a plant.

22. A planter according to any of claims 17 or 19 to 21, characterised in that the engagement of the spacer member with the upper surface limits downward movement of the spacer, thereby enabling the fingers to be driven down at its sides, so that they can enter the root portion, converge and grip the root portion.

23. A planter according to any of claims 17 or 19 to 22, characterised in that the spacer member is locatable between a retracted position and an extended position, in
5 the extended position, the spacer member is configured such that the finger tips are prevented from extending beyond the lower edge of the spacer member.

24. A planter according to any of claims 17 or 19 to
10 23, characterised in that the planter comprises a plurality of plant extraction means, the planter further comprising means for actuating the respective fingers of the plant extraction means to converge substantially simultaneously.

15 25. A planter according to any of claims 1 to 15, 17 or 19 to 24, characterised in that the planter comprises spacing means for setting the extraction means spacing in accordance with the propagation trays.

20 26. A planter according to any of claims 1 to 15, 17 or 19 to 25, characterised in that the planter comprises a plurality of plant extraction means, arranged in a row whereby a row of plants can be pulled out of a propagation tray simultaneously.

25 27. A planter according to claim 26, characterised in that the planter comprises means for adjusting the separation of the plant extraction means in a row.

30 28. A planter according to any of claims 1 to 15 or any of claims 17 or 19 to 27, characterised in that the planter is a field planter.

29. A method of automated planting comprising
35 providing:

a) means adapted to extract a plant out of a propagation tray;

b) a delivery assembly arranged to receive extracted plants and to deliver the plants to the ground;

5 c) plant transport means arranged to receive extracted plants from the extraction means to present said plants to the delivery assembly;

characterised in that

10 the plant transport means comprises a first and a second plant conveyor, each conveyor being adapted to receive extracted plants, and means for controlling the conveyors,

the method comprising

15 controlling the plant transport means to hold one conveyor in a static state to receive the plants from said plant extraction means whilst the second conveyor is driven to present previously deposited plants to the delivery assembly.

20 30. A method according to claim 29, characterised in that the transport means are adapted to receive an extracted row of plants from the plant extraction means and the extracted plants are presented sequentially to the delivery assembly.

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31. A method of automated planting comprising providing;

a) a delivery assembly for receiving extracted plants and to deliver said plants to the ground;

30 b) a conveyor to present plants to the delivery assembly, the conveyor comprising a plurality of holding ports;

c) a controller for controlling the position of the holding ports relative to the delivery assembly;

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d) a sensor

characterised in that the method comprises advancing the conveyor in response to the sensor such that the delivery assembly receives plants at a uniform rate.

5 32. A method according to any of claims 29 or 30, characterised in that the conveyor comprises a plurality of holding ports, the planter comprising a controller for controlling the position of the holding ports relative to the delivery assembly and a sensor, the method comprising
10 advancing the conveyor in response to the sensor, such that the delivery assembly receives extracted plants at a uniform rate.

 33. A method according to claim 31 or 32,
15 characterised in that the sensor is adapted to sense plant foliage and the conveyor is indexed so that the delivery assembly receives properly developed plants at a uniform rate.

20 34. A method of automated planting comprising
 a) providing means for extracting a plant out of a propagation tray;
 b) providing means for delivering extracted plants to the ground;
25 the extraction means comprising means for inserting at least one insertion member into the root portion of a plant to grip the root portion;
 characterised in that the extraction means:
 approach a row of plants from a direction transverse
30 to the row; and
 pull the plant out of the propagation tray.

 35. A method according to claim 34, characterised in that the extraction means push the foliage of the plants to
35 one side before inserting the insertion member.

36. A method according to any of claims 29 to 33,
characterised in that the plant extraction means comprising
means for inserting at least one insertion member into the
5 root portion of a plant to grip the root portion,
characterised in that the extraction means:

approach the row of plants from a direction transverse
to the row,

10 and pull the plant out of the propagation tray.

37. A method according to claim 36, characterised in
that the extraction means push the foliage of the plant to
one side before inserting the insertion member

15 38. A method according to any of claims 34 or 37,
characterised in that the base of the root portion is
separated from the top of the propagation tray the
extracted plant being moved transversely to the upper
surface of the propagation tray whereby the plant is
20 separated from adjacent plants with which its foliage may
have been entangled, without pulling said adjacent plants
out of the propagation tray.

39. A method according to any of claims 34 to 38,
25 characterised in that a row of plants is pulled
simultaneously from the propagation tray.

40. A method according to any of claims 29 to 39,
characterised in that a row of plants is extracted in
30 alignment and the row is translated in a direction
perpendicular to that line, the line of plants being
deposited in relation to the plant transport means.

41. A method of automated planting comprising:
35 a) providing a planter comprising means for

extracting plants from a propagation tray;

b) providing holding ports to locate and hold the plants;

characterised in that the planter comprises extraction
5 members adapted for insertion into the root portion of the plants,

the method comprising driving the extraction members generally transversely into the root portion of the plants to hold the plants in the holding ports whilst said
10 extraction means are withdrawn.

42. A method according to any of claims 29 to 40, characterised in that the method comprises

providing holding ports to locate and hold the plants;
15 the planter comprising extraction members adapted for insertion into the root portion of the plants,

the method comprising driving the extraction members generally transversely into the root portion of the plants to hold the plants in the holding ports whilst said
20 extraction means are withdrawn.

43. A method of extracting plants comprising providing:

a) fingers, the fingers being sprung such that ends
25 of the fingers are biased towards each other,

b) a spacer member located between the fingers,
the method comprising engaging the spacer member with an upper surface of a root portion of a plant to allow the fingers to be driven down past the sides of the spacer
30 member, whereby the fingers are inserted into the root portion and the fingers converge to grip the root portion.

44. A method according to any of claims 29 to 42, characterised in that the method comprises providing:

35 a) fingers, the fingers being sprung such that ends

of the fingers are biased towards each other,

b) a spacer member located between the fingers,
the method comprising engaging the spacer member with
an upper surface of a root portion of a plant to allow the
5 fingers to be driven down past the sides of the spacer
member.

45. A method according to claim 44, characterised in
that the method comprises providing stop means, the stop
10 means limiting movement of the spacer member so as to
prevent or limit compression of the root portion surface by
the spacer member.

46. A method according to any of claims 43 or 44 or
15 43, characterised in that the engagement of the spacer
member with the upper surface limits downward movement of
the spacer, thereby enabling the fingers to be driven down
at its sides, so that they can enter the root portion,
converge and grip the root ball.

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47. A method according to any of claims 44 to 46,
characterised in that the method comprises providing a
plurality of plant extraction means, and actuating the
respective fingers of the plant extraction means to converge
25 substantially simultaneously.

48. A method according to any of claims 29 to 47,
characterised in that the method comprises spacing the
extraction means in accordance with the propagation trays.

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49. A method according to any of claims 29 to 48,
characterised in that the planter comprises a plurality of
plant extraction means, arranged in a row whereby a row of
plants is pulled out of a propagation tray simultaneously.

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50. A method according to claim 49, characterised in that the method comprises adjusting the separation of the plant extraction means in a row.

5 51. A method according to any of claims 29 to 42 or any of claims 42 to 49 characterised in that the method is a method of automatic field planting.

10 52. An automatic planter according to any of claims 1 to 15 or any of claims 17 or 19 to 27, characterised in that the planter is a mobile planter.

53. A planter as hereinbefore described and as shown in any of the accompanying drawings.

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STATEMENT UNDER ARTICLE 19 (1)

Claim 1 is based on the disclosure on page 1, line 26 in combination with original claims 1, 2, 20 and 23 and page 8, line 7 - 19 of the original application.

Claim 2 is based on claim 24.

Claim 3 is based on claim 33 as originally filed.

Claim 4 is based on original claim 37.

Claim 5 is based on the disclosure on page 1, line 3; page 22, line 15 through to page 23, line 15 of the original application.

Claim 6 is based on the disclosure on page 22, line 29 through to page 23, line 13 of the original application.

Claim 7 is based on the disclosure on page 22, line 28 to page 23, line 8 and original claim 32.

Claim 8 is based on original claim 32.

Claim 9 is based on original claim 29 and the disclosure on page 6, lines 22 - 26.

Claims 10 and 11 are based on the disclosure on page 8, line 20 through to page 9, line 20 of the original application.

Claim 12 is based on original claim 12.

Claim 13 is based on the disclosure on page 9, lines 15 to 20 of the original application.

Claim 14 is based on the disclosure on page 9 of the original application.

Claim 15 is based on original claim 29, lines 15 - 20 of the original application.

Claims 16, 17, 18 and 19 are based on original claims 7 through to 10.

Claim 20 is based on original claim 11.

Claim 21 is based on claim 9 and Figure 10 of the drawings.

Claim 22 is based on original claim 8 and the disclosure on page 20, lines 11 to 17 of the original application.

Claim 23 is based on the disclosure on page 18, line 5 - 8 of the original application..

Claim 24 is based on original claim 14.

Claim 25 is based on original claim 16 and the disclosure on page 5, lines 4 - 11 of the original application.

Claim 26 and 27 are based on original claims 16, 14 and 12.

Claim 28 is based on disclosure on page 1, lines 1 - 30 of the original application.

Method claims 29 through to 51 correspond to apparatus claims 1 through to 27.

Claim 52 is based on the disclosure on page 2, lines 1 - 13 of the original application.